AC 2008-865: UNDERSTANDING STUDENTS' USE OF INNOVATIVE LEARNING STRATEGIES

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Promoting Innovative Design

In an effort to understand how educators might most effectively introduce students to innovative thinking, this study investigates students' use of innovation in their development of design solutions. Researchers hypothesize that problem-solving environments influence the degree to which learners exhibit innovative problem-solving approaches. Guided by Schwartz, Bransford, and Sears‘ (2005) adaptive expertise framework, we explore how a problem’s structure influences students' use of innovative problem-solving strategies. We specifically define two components of innovation for investigation: knowledge-application innovation (i.e. the ability to recognize when certain knowledge applies) and solution innovation (i.e. the range and novelty of ideas produced in the solution search).

Participants in the study include students from mechanical engineering, chemical engineering, and biology departments at one public and one private institution. The use of innovative problem-solving approaches among these students was explored through four think-aloud problem-solving sessions during which students solved a well-defined and an ill-defined design problem. These problems were constructed by referencing Jonassen’s (2000) outlined attributes of problems to ensure that they differed only in their degree of structure. During their first encounter with each problem, students were given up to one hour to work on their design solution. To provide the opportunity for reflection that is true of real-life problem-solving situations, students were also asked to revisit each problem several days later; again being given up to one hour to work. To control for effects that might arise due to the order in which problems were solved, half of the participants solved the ill-structured problem followed by the well-structured problem. The remainder of the participants solved the problems in reverse order.

Students’ design solutions were analyzed to determine the degree to which they exhibited knowledge-application innovation and solution innovation. Knowledge application innovation was assessed by using a rubric designed to measure how many points of applicable content knowledge were applied by the student during the generation of a solution. Similarly, solution innovation was assessed using an instrument constructed to measure a design’s creative qualities. A second measure of solution innovation included a count of the number of different solutions students considered as they worked on each problem.

The results from this study provide educators with insights on the types of problems that may be most effective for introducing students to innovative thinking. Students’ responses to ill- and well-structured problems provide the basis for recommendations about the methods educators might use to best prepare their students for the kind of thinking that is required of practicing engineers.